

# ROTATABLE ELECTRICAL PLUG

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

5           The present invention relates generally to electrical plugs for electric appliances and, more particularly, to a rotatable electrical plug.

### 2. Description of the Related Art

          The conventional electrical plug of the power cord of an electrical appliance is not rotatable relative to the power cord. When inserted into an electrical socket, the  
10   hard electrical plug is firmly held in place; however the flexible power cord may curve subject to external force. When using a portable electric appliance, for example, a vacuum cleaner, air dryer, electric hand tool or the like, the power cord may be stretched frequently, and the electric connection between the power cord and the electrical plug tends to be broken, resulting in a short circuit.

15           US patent No. 5,399,093 and US patent No. 5,775,921 both provide a rotatable electrical plug, in which a rotative connection is provided between the power cord and the prongs, so that the housing can be biased subject to the position change of the electric appliance after connection of the electrical plug to an electrical socket. According to these designs, a rotative coupling device with concentrically arranged  
20   annular contacts provides the rotative connection between the power cord and the prongs. The main drawback of these designs is the complicated connection structure between the power cord and the rotative coupling device. According to US patent No. 5,399,093, annular conductors 52 are electrically connected to respective ones of the power cord conductors 48 via connection arms 80a, 80b, 80c which extend from  
25   annular conductors 52, each connection arm 80 terminating in a wire crimp 82a, 82b,

82c which attaches the respective connection arm to a respective power cord conductor 48. According to US patent No. 5,775,921, connection tip 191 is provided at the annular metal cushion, and side openings 133, 134, 183 are respectively formed in the upright annular flanges 13, 18 for the passing of electric wires 21, 22, 23. The complicated structural design greatly increases the manufacturing cost of the electrical plug.

Further, the aforesaid two prior art designs use spring means (arcuate and linear spring contacts 54a, 54b, 54c in US patent No. 5,399,093) to enhance the reliability of the connection between the power cord and the prongs. The spring means simply complicates the structure without providing any added function.

Therefore, it is desirable to provide a rotatable electrical plug that eliminates the aforesaid drawbacks.

## **SUMMARY OF THE INVENTION**

It is the primary object of the present invention to provide a rotatable electrical plug, which prevents distortion of the power cord of the electric appliance, prolonging the service life of the product and ensuring the safety of the use of electric appliance.

It is another object of the present invention to provide a rotatable electrical plug, which has a simple structure and is inexpensive to manufacture, and easy to install.

To achieve these objects of the present invention, the rotatable electrical plug comprises a housing having an inner cover shell, an outer cover shell abutted against the inner cover shell, a wire hole, an opening formed in the inner cover shell, and a substrate provided inside the outer cover shell. A rotary prong holder is mounted inside

the housing and rotatably coupled to the opening in the inner cover shell. At least two prongs are respectively fastened to the rotary prong holder, the at least two prongs each having an outer side respectively extended out of the opening in the inner cover shell and an inner side respectively fastened to the rotary prong holder, the at least two  
5 prongs including one center prong and at least one side prong, the inner side of the center prong being fastened to a center of rotation of the rotary prong holder, the inner side of each of the at least one side prong being fastened to the rotary prong holder and spaced from the center of rotation of the rotary prong holder at a different distance. At least one annular contact member is respectively mounted on one side of the rotary  
10 prong holder opposite to the opening in the inner cover shell and concentrically arranged around the center of rotation of the rotary prong holder and respectively electrically connected to the at least one side prong. And at least two connecting members are respectively affixed to the substrate, the number of the at least two connecting member being equal to the number of the at least two prongs, the at least  
15 two connecting members each having a connecting portion for the connection of an electric wire and a contact portion respectively disposed in contact with the inner side of the center prong and the at least one annular contact member.

According to an alternate form of the present invention, the rotary electrical plug comprises a housing having an inner cover shell, an outer cover shell abutted  
20 against the inner cover shell, a wire hole, an opening formed in the inner cover shell, and a substrate provided inside the outer cover shell; a rotary prong holder mounted inside the housing and rotatably coupled to the opening in the inner cover shell; at least two prongs respectively fastened to the rotary prong holder, the at least two prongs each having an outer side respectively extended out of the opening in the inner cover  
25 shell and an inner side respectively fastened to the rotary prong holder and spaced from

the center of rotation of the rotary prong holder at a different distance; a plurality of annular contact members respectively mounted on one side of the rotary prong holder opposite to the opening in the inner cover shell and concentrically arranged around the center of rotation of the rotary prong holder and respectively electrically connected to

5 the at least two prongs, the number of the annular contact members being equal to the number of the at least two prongs; and a plurality of connecting members respectively affixed to the substrate, the number of the connecting members being equal to the number of the at least two prongs, the connecting members each having a connecting portion for the connection of an electric wire and a contact portion respectively

10 disposed in contact with the contact members.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is an exploded view of a rotatable electrical plug according to a first preferred embodiment of the present invention.

15 FIG. 2 is a perspective view of the rotatable electrical plug according to the first preferred embodiment of the present invention.

FIG. 3 is another perspective view of the rotatable electrical plug according to a first preferred embodiment of the present invention.

FIG. 4 is a sectional view, in an enlarged scale, taken along line 4-4 of FIG.

20 2.

FIG. 5 is a sectional view, in an enlarged scale, taken along line 5-5 of FIG.

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FIG. 6 is a top plain view in an enlarged scale of the rotatable electrical plug according to the first preferred embodiment of the present invention after removal of

25 the outer cover shell.

FIG. 7 is an exploded view of a rotatable electrical plug according to a second preferred embodiment of the present invention.

FIG. 8 is a perspective of the rotatable electrical plug according to the second preferred embodiment of the present invention.

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## **DETAILED DESCRIPTION OF THE INVENTION**

Referring to FIGS. 1~6, a rotatable electrical plug **1** in accordance with the first preferred embodiment of the present invention is shown comprised of a housing **10**, a rotary prong holder **30**, three prongs **40a**, **40b** and **40c**, two contact members **50a** and **50b**, and three connecting members **60a**, **60b** and **60c**.

The housing **10** is comprised of an inner cover shell **11** and an outer cover shell **12**. The cover shells **11** and **12** fit each other in shape, and are respectively molded from plastics. As illustrated in FIG. 1, the cover shells **11** and **12** each have a circular upper part, and a trapezoidal lower part, which has a width made gradually smaller from the circular upper part. Each cover shell **11** or **12** has a circular opening **19a** or **19b** in the circular upper part. The circular opening **19b** of the outer cover shell **12** is closed by a cap **20**. The inner cover shell **11** has four countersunk holes **13** in the trapezoidal lower part. The outer cover shell **12** has four female screws **14** perpendicularly extended from the trapezoidal lower part. Screws **15** are respectively mounted in the countersunk holes **13** and threaded into the female screws **14** to fixedly secure the cover shells **11** and **12** together. A substrate **18** is mounted in the circular upper part of the outer cover shell **12** and spaced from the circular opening **19b** at a distance, having three mounting portions **18a**, **18b** and **18c**. The cover shells **11** and **12** each further have a semicircular bottom notch **16a** or **16b** in the bottom side of the

respective trapezoidal lower part. When the cover shells **11** and **12** fastened together, the semicircular bottom notch **16a** and **16b** form a circular wire hole **17** for the passing of electric wires **70a**, **70b** and **70c** to the outside of the housing **10**.

The rotary prong holder **30** is comprised of an upper holder plate **31** and a  
5 lower holder plate **32**. The holder plates **31** and **32** are circular plate members respectively molded from plastics and arranged in a stack. The diameter of the upper holder plate **31** is smaller than the lower holder plate **32**. The upper holder plate **31** has a circular through hole **33** through the center, and a notch **34** in the periphery. The diameter of the lower holder plate **32** is slightly greater than the circular opening **19a**  
10 of the inner cover shell **11**. The lower holder plate **32** has a coupling block **35** projected from one side, namely, the inner side and coupled to the circular opening **19a** of the inner cover shell **11**, an annular locating flange **36** projected from the other side, namely, the outer side and adapted to accommodate the upper holder plate **31** therein, and three through holes **37a**, **37b** and **37c** extended through the inner and outer sides  
15 and the coupling block **35**. The first and second through holes **37a** and **37b** are rectangular through holes. The third through hole **37c** is a circular through hole. The rotary prong holder **30** is mounted inside the housing **10**, and coupled to the circular opening **19a** of the inner shell **11** with the coupling block **35** for free rotation relative to the housing **10**.

20 The three prongs **40a**, **40b**, and **40c** are fastened to the rotary prong holder **30**. The first and second prongs **40a** and **40b** are substantially L-shaped metal plate members, each having a relatively longer and longitudinally extended front side and a relatively shorter and transversely extended rear side. The first and second prongs **40a** and **40b** each further has a cylindrical (or tubular) mounting legs **41a** or **41b**  
25 perpendicularly backwardly extended from the respective rear side. The first and

second prongs **40a** and **40b** have the respective longer front sides respectively inserted through the rectangular first and second through holes **37a** and **37b** of the rotary prong holder **30** to the outside of the housing **10** and the respective shorter rear sides sandwiched in between the holder plates **31** and **32**, keeping the mounting legs **41a** and **41b** respectively extended through the circular through hole **33** and notch **34** of the upper holder plate **31**. The third prong **40c** is metal round rod fastened to the circular third through hole **37c** of the lower holder plate **32**. After installation of the prongs **40a**, **40b**, and **40c** in the rotary prong holder **30**, the prongs **40a**, **40b**, and **40c** have a part respectively extended out of the housing **10** through the circular opening **19a** of the inner cover shell **11** for insertion into “hot slot”, “neutral slot”, and “ground slot” of a three-slot electrical socket (not shown).

The two contact members (first and second contact members) **50a** and **50b** are annular metal members concentrically mounted on the prong holder **30**. The first contact member **50a** is mounted on the upper holder plate **31** corresponding to the outer cover shell **12**, and soldered to the mounting leg **41b** of the second prong **40b** (keeping the upper holder plate **31** and the lower holder plate **32** fixedly secured together). The second contact member **50b** is mounted on the lower holder plate **31** corresponding to the outer cover shell **12**, and soldered to the third prong **40c**.

The three connecting members (first, second and third connecting members) **60a**, **60b**, and **60c** are metal members, each having a tubular connecting portion **61a**, **61b**, or **61c** respectively connected to the mounting portions **18a**, **18b**, and **18c** of the substrate **18**, and a contact portion **62a**, **62b**, or **62c**. The contact portion **62a** of the first connecting member **60a** is shaped like an open barrel and sleeved onto the mounting leg **41a** of the first prong **40a**. The contact portions **62b** and **62c** of the second and third connecting members **60b** and **60c** are spring strips respectively

pressed on the first and second contact members **50a** and **50b**.

According to the aforesaid arrangement, the contact members **50a** and **50b** are concentrically arranged around the cylindrical mounting leg **41a** of the first prong **40a**, therefore the first connecting member **60a** is constantly maintained in close  
5 contact with the first prong **40a**, and the second and third connecting members **60b** and **60c** are respectively constantly maintained in close contact with the contact members **50a** and **50b** when rotating the rotary prong holder **30** relative of the housing **10** to any desired angle.

The rotatable electrical plug **1** of the aforesaid first embodiment of the  
10 present invention can be used as a three-prong plug for a conventional electric appliance. When connecting to a power cord, the three electric wires (neutral wire, hot wire, and grounding wire) **70a**, **70b**, and **70c** are soldered to the connecting portions **61a**, **61b**, and **61c** of the connecting members **60a**, **60b**, and **60c**. The electric wires **70a**, **70b**, and **70c** are set at the back side of the substrate **18** (in the gap between the  
15 substrate **18** and the circular opening **19b** of the outer cover shell **12**), and extended out of the housing **10** through the wire hole **17**.

When in use, insert the prongs **40a**, **40b**, and **40c** into the hot, neutral, and ground slots of a three-slot electrical socket, for enabling electric current to pass through the contact members **50a** and **50b** and the connecting members **60a**, **60b**, and  
20 **60c** to the electric appliance via the power cord. Because the prongs **40a**, **40b**, and **40c** are affixed to the rotary prong holder **30**, the rotary prong holder **30** is firmly secured to the electrical socket when rotating the housing **10** of the rotatable electrical plug **1**, and rotating the housing **10** relative to the rotary prong holder **30** does not interfere with the transmission of electricity from the electrical socket to the electric appliance.  
25 Therefore, when changing the position of the electric appliance, the housing **10** of the



rotatable electrical plug **1** can be biased to the corresponding angle without distorting the power cord. Therefore, the invention greatly prolongs the service life of the product, and ensures the safety of the use of electric appliance.

The main features of the aforesaid first embodiment of the present invention  
5 are as follows:

1. The three connecting members **60a**, **60b**, and **60c** are respectively connected to the three wires of the power cord to hold the electric wires of the power cord in place and to electrically connect the power cord to the contact members **50a** and **50b**, which are respectively connected to the second and third prongs **40b** and **40c**  
10 at the rotary prong holder **30**. Because of the structure of the rotatable electrical plug **1** is simple and its installation procedure is easy, the manufacturing cost of the rotatable electrical plug **1** is low.

2. A backward displacement of the prongs **40a**, **40b**, and **40c** may distort internal members of the rotatable electrical plug **1**, causing a false connection. The  
15 upper and lower holder plates **31** and **32** of the rotary prong holder **30** hold the short sides of the first and second prongs **40a** and **40b** firmly in place, preventing backward displacement of the prongs **40a**, **40b**, and **40c** upon accidental contact of an external hard body.

3. After opening of the cap **20** from the outer cover shell **12**, the user can  
20 visually check the connection status between the electric wires **70a**, **70b**, and **70c** and the connecting members **60a**, **60b**, and **60c** at the substrate **18** through the circular opening **19b** of the outer cover shell **12**, and repair or replace the members of the circuit.

FIGS. 7 and 8 show a rotatable electrical plug **1'** according to the second  
25 embodiment of the present invention. According to this embodiment, the rotatable

electrical plug **1'** is a two-prong electrical plug for connection to a two-slot electrical socket, comprised of a housing **10'**, which is identical to the housing **10** of the aforesaid first embodiment of the present invention, a rotary prong holder **30'**, which is substantially similar to the rotary prong holder **30** of the aforesaid first embodiment of the present invention with the exception of having only two through holes **37a'** and **37b'**), two prongs (first and second prongs) **40a'** and **40b'**, which are similar to the first and second prongs **40a** and **40b** of the aforesaid first embodiment of the present invention and respectively fastened to the through holes **37a'** and **37b'** of the rotary prong holder **30** for insertion into the hot and neutral slots of a two-slot electrical socket, a contact member **50'**, which is similar to the first contact member **50** of the aforesaid first embodiment of the present invention, for connection to the second prong **40b'** electrically, and two connecting members **60a'** and **60b'** respectively connected to the first prong **40a'** and disposed in contact with the contact member **50'**. In general, this embodiment uses two prongs to substitute for the three prongs of the aforesaid first embodiment. Mainly, the second embodiment has the rotary prong holder **30'** made in a circular shape and, eliminates the grounding third prongs, grounding third contact member and grounding third connecting member as used in the aforesaid first embodiment of the present invention.

Further, it is to be understood that the mounting leg of the first prong according to the second embodiment of the present invention is fastened to the center of the rotary prong holder. Therefore, one contact member is sufficient, and the mounting leg of the first prong is directly pivoted to the first connecting member. In actual practice, two contact members may be used and respectively connected to the prongs for the contact of respective spring strip-like contact portions of the connecting members respectively.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.